

Heat of Vaporization and Heat of Fusion Worksheet

1. How much heat is required to melt 360 g of solid water? Important constant: H_{fus} of water is 334 J/g.

$$\begin{aligned} Q &= m H_{\text{fus}} \\ &= (360\text{g})(334\text{J/g}) \\ Q_{\text{required}} &= 120240\text{J} = \boxed{1.2 \times 10^5 \text{J}} \end{aligned}$$

2. How much heat is required to vaporized 24 g of liquid water? H_{vap} of water is 2257 J/g.

$$\begin{aligned} Q &= m H_{\text{vap}} \\ &= (24\text{g})(2257\text{J/g}) \\ Q &= 54168\text{J} \\ Q_{\text{required}} &= \boxed{5.4 \times 10^4 \text{J}} \end{aligned}$$

3. For a 500g block of lead (Pb) to melt, how much energy is needed? H_{fus} of lead is 23 J/g.

$$\begin{aligned} Q &= m H_{\text{fus}} \\ &= (500\text{g})(23\text{J/g}) \\ Q &= 11500\text{J} \\ Q_{\text{req}} &= \boxed{1.15 \times 10^4 \text{J}} \end{aligned}$$

4. Mercury is a metal that is a liquid at room temperature. In order to solidify 7.5g of it, how much energy needs to be removed? H_{fus} of Hg is 11.3 J/g. 5. What is the heat of vaporization of ammonia (NH_3) if 0.15 g of it requires 206.5 J for evaporation?

2. Mercury

$$\begin{aligned} Q &= m H_{\text{fus}} \\ &= (7.5\text{g})(11.3\text{J/g}) \\ Q_{\text{removed}} &= \boxed{84.75\text{J}} \end{aligned}$$

NH_3

$$\begin{aligned} Q &= m H_{\text{vap}} \\ 206.5\text{J} &= (0.15\text{g}) H_{\text{vap}} \\ H_{\text{vap}} &= \boxed{1377\text{J}} \end{aligned}$$

5. Ethanol ($\text{C}_2\text{H}_5\text{OH}$) very easily changes from a liquid to a gas. If 29.34g of ethanol uses 32.23J of energy what would its H_{vap} be?

$$\begin{aligned} Q &= m H_{\text{vap}} \\ 32.23\text{J} &= (29.34\text{g}) H_{\text{vap}} \\ H_{\text{vap}} &= \boxed{1.1\text{J/g}} \end{aligned}$$

6. Iron is the heaviest metal vaporized in the sun. Its H_{vap} is 6071.43 J/g. How much heat is needed to turn (keep) 0.5 kilograms of iron into a gas?

$$Q = m H_{\text{vap}} \\ = (0.5 \text{ kg}) (6071.43 \frac{\text{J}}{\text{g}}) \times (\frac{1000 \text{ g}}{\text{kg}}) \\ Q = 3035715 \text{ J} \quad \boxed{Q = 3036 \text{ kJ}}$$

7. In order for 5g liquid Hydrogen to become a solid, 12J of energy must be removed. What is the H_{fus} for the element, Hydrogen?

$$Q = m H_{\text{fus}} \\ 12 \text{ J} = (5 \text{ g}) H_{\text{fus}} \\ \boxed{H_{\text{fus}} = 2.4 \frac{\text{J}}{\text{g}}}$$

8. If 2083 Joules are used to melt 5.26 grams of aluminum, what is the heat of fusion of aluminum?

$$Q = m H_{\text{fus}} \\ 2083 = (5.26 \text{ g}) H_{\text{fus}} \\ \boxed{H_{\text{fus}} = 396 \text{ J}}$$

9. What is the mass of a sample of Nickel, which completely melts after 3120 J of heat? (ΔH_{fus} of nickel is 298 J/g)

$$Q = m H_{\text{fus}} \\ 3120 \text{ J} = m (298 \frac{\text{J}}{\text{g}}) \\ \boxed{m = 10.5 \text{ g}}$$